NAME: Key

no outcomes in common   one event doesn't affect other event

1. Decide whether the following sets of 2 events are disjoint, independent, both, or neither?
   a. Rolling a dice and flipping a coin

      disjoint and independent

   b. (From a standard 52 card deck) Picking an Ace and picking a red card (with replacement in between each pick)

      not disjoint, but independent
      (there are red aces)

   c. Rolling a 6 and rolling a 3

      disjoint ~~and~~ and indep.

   d. Rolling a 6 and rolling an even number

      not disjoint, but independent

   e. Flipping a coin; [redacted] getting a HEAD and getting a TAIL

      disjoint & independent

2. If P(A) = 0.60 and P(B) = 0.21 and P(A∩B) = 0.09, find the following:
   a. P(A U B) = $P(A)+P(B)-P(A\cap B) = 0.6+0.21-0.09 = 0.72$

   b. P(B|A) = $\dfrac{P(A\cap B)}{P(A)} = \dfrac{0.09}{0.60} = 0.15$

   c. Are A and B disjoint events? Why or why not?

      no, $P(A\cap B) \neq 0$

   d. Are A and B independent? Why or why not?

      no, $P(A\cap B) \neq P(A)\cdot P(B)$ $P(B|A) \neq P(B)$

3. If P(D) = 0.17, P(C) = 0.54 and D and C are disjoint what is the probability of D or C?

   $P(D\cup C) = P(D)+P(C) = 0.17+0.54 = 0.71$

4. If P(K)= 0.68, P(R)= 0.22 and K and R are independent, what is the probability of K and R?

   $P(K\cap R) = P(K)\cdot P(R) = (0.68)(0.22) = 0.1496$

5. If P(F) = 0.51 and P(H) = 0.22 and P(H|F) = 0.12, find the following:

   a. P(F and H) = $P(F \cap H) = P(F) \cdot P(H|F) = (0.51)(0.12) = 0.0612$

   b. P(F or H) = $P(F \cup H) = P(F) + P(H) - P(F \cap H) = 0.51 + 0.22 - 0.0612$

      0.6688

   c. What is $P(F^c)$? $1 - P(F) = 1 - 0.51 = 0.49$

   d. What is the complement of H?

      $1 - P(H) = 1 - 0.22 = 0.78$

6. Let the sample space, S = {all whole number from 5 through 20}
   Let the event A = {5, 8, 10, 11, 14, 18, 19, 20}
   Let the event B = {6, 8, 10, 12, 14, 16, 18, 20}
   Let the event C = {5, 7, 9, 11, 13, 15, 17, 19}

   Find the following:

   a. $A \cap B = \{8, 10, 14, 18, 20\}$

   b. $P(A \cap B) = 5/16$

   c. $B^c = \{5, 7, 9, 11, 13, 15, 17, 19\}$

   d. $P(B \cap C) = 0$

   e. $P(A \cap C) = 3/16$

   f. $P(A^c) = 8/16$

   g. $C \cup B = \{5, 6, 7, 8, 9, \ldots, 18, 19, 20\}$

the next 2 questions, put the probability statements into notation to help you.

7. On a certain day, there is a 21% chance of John being absent. The probability of there being a pop quiz **and** John being absent is 15%. What is the probability that there is a pop quiz **given that** John is absent?

$$P(A)=0.21$$
$$P(Q\cap A)=0.15$$
$$P(Q|A)=\frac{0.15}{0.21}=0.7143$$

8. The chance of Kelly wanting cereal for breakfast is 48%. The chance that Kelly has Milk in her fridge **and** her wanting cereal is 39%. What is the chance that Kelly has milk **given that** she wants cereal.

$$P(C)=0.48$$
$$P(M\cap C)=0.39$$
$$P(M|C)=\frac{P(M\cap C)}{P(C)}=\frac{0.39}{0.48}=0.8125$$

9. There are 30 books on a shelf. Jimmy wants to select 7 books to read this summer. How many groups of 7 can he select?

$$30\ nCr\ 7 = 2{,}035{,}800$$

10. License plates in NJ are made up of 2 letters followed by 4 digits followed by 1 letter. Letters cannot be repeated. How many different ways can we do this?

$$\underline{26}\cdot\underline{25}\cdot\underline{10}\cdot\underline{10}\cdot\underline{10}\cdot\underline{10}\cdot\underline{24} = 156{,}000{,}000$$

11. You are at a buffet and want to make a dinner platter for yourself with a main course, a side dish, a salad and a dessert. There are 10 choices for main dishes, 6 side dishes, 3 salads, and 5 desserts. How many different platters can you create?

$$\underline{10}\cdot\underline{6}\cdot\underline{3}\cdot\underline{5}=900$$

12. The PTA wants to create a group of parents to advise the school on issues. They want 4 dads and 4 moms to be on the committee. There are 51 men and 70 women. How many possibilities are there?

$$(51\ nCr\ 4)\cdot(70\ nCr\ 4)=2.291\times 10^{11}$$

13. On a typical large plane, there are 150 seats. The chance that the plane is completely filled is 56%. The chance that the plane has 120 seats filled is 24%. The chance that the plane has 70 seats filled is 12% and the chance that the plane has only 30 seats filled is 8%.

a. Create a probability model for the **number of passengers** on the plane

X	150	120	70	30
$P(x)$	0.56	0.24	0.12	0.08

b. What is the expected attendance on a 747 flight?

$E(x) = 123.6$ people

c. What is the chance that less than 100 seats will be filled?

$P(X < 100) = 0.20$

d. What is the chance that more than 70 seats are filled?

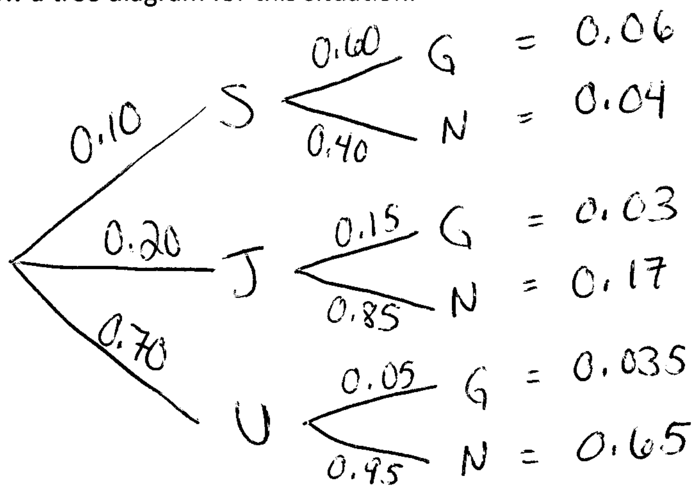
$P(x > 70) = 0.80$

e. If there are 50 flights in a day, what is the ~~total~~ expected attendance?

$50 \times 123.6 = 6180$ people

14. For purposes of making on-campus housing assignments, a college separates its students by grade: Seniors, Juniors, and Underclassmen. Of the students who choose to live on campus, 10% are seniors, 20% are juniors, and the rest are underclassmen. The most desirable dorm is the newly constructed Gold dorm, and 60% of the seniors elect to live there. 15% of the juniors also live there, along with only 5% of the underclassmen.

a. Draw a tree diagram for this situation.



b. What is the probability that a randomly selected on-campus student lives in ~~the Gold dorm~~?

$P(G) = 0.06 + 0.03 + 0.035 = 0.125$

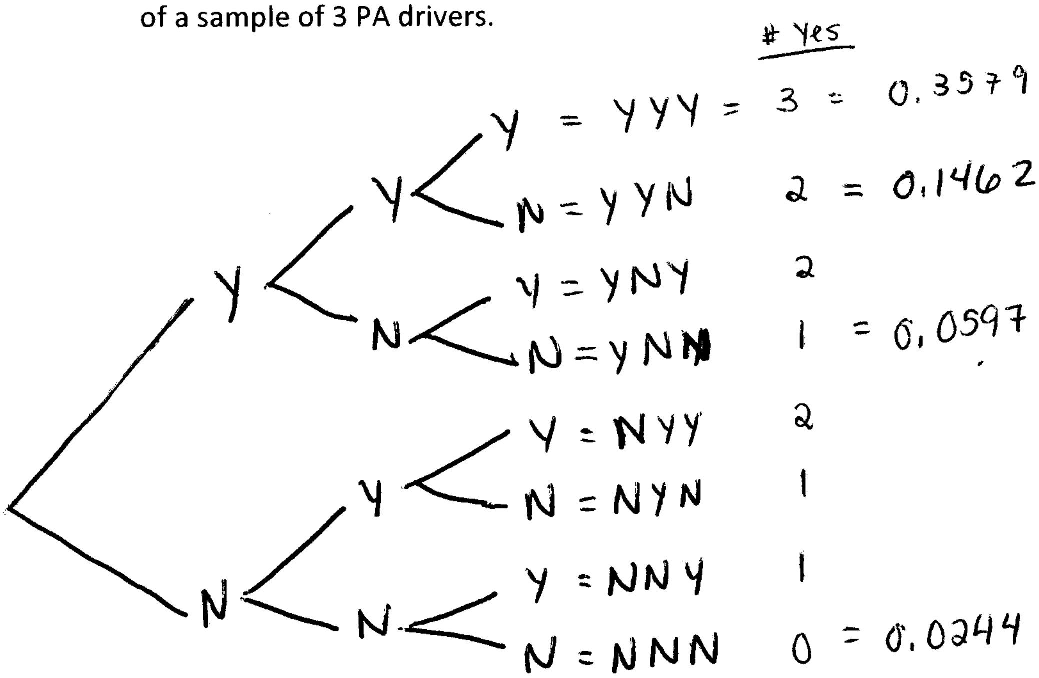
c. Given that a student lives in the Gold dorm, what is the probability that they are a senior?

$$P(S \mid G) = \frac{P(S \cap G)}{P(G)} = \frac{0.06}{0.125} = 0.48$$

15.

Suppose that 71% of Pennsylvanian drivers use EZPass to pay their tolls.

a. Use a tree diagram to create the probability model for X, the number of EZPass users out of a sample of 3 PA drivers.



X	0	1	2	3
P(x)	0.0244	0.1791	0.4386	0.3579

= 1

b. What is the probability that there ~~will be exactly~~ 3 EZPass users?

$P(x=3) = 0.3579$

c. What is the probability that at least 1 PA driver uses EZPass?

$P(x \geq 1) = 0.9756$

d. What is the probability that 2 or less drivers use EZPass?

$P(x \leq 2) = 0.6421$

e. What is the probability that everyone in the sample pays cash instead?

$P(x = 0) = 0.0244$

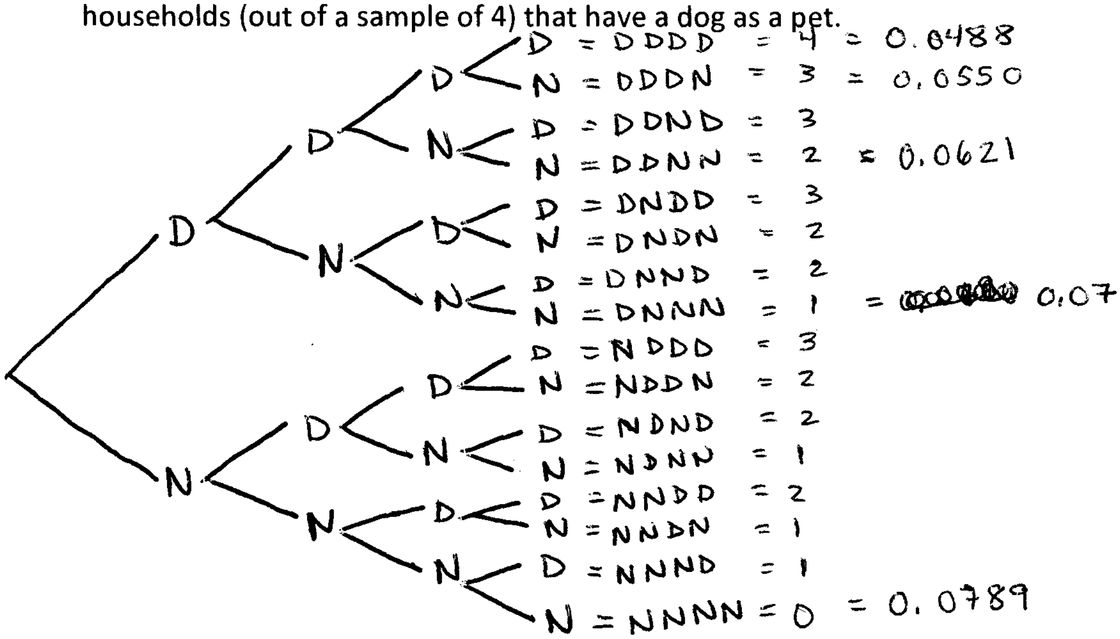
f. What is the probability that only 2 drivers in the sample use EZPass?

$P(x=2) = 0.4386$

16.

Suppose that 47% of American households have a dog as a pet.

a. Use a tree diagram to create the probability model for X, the number of American households (out of a sample of 4) that have a dog as a pet.



X	0	1	2	3	4	
P(x)	0.0789	0.28	0.3726	0.22	0.0488	= 1

b. What is the probability that there will be exactly 4 households with dogs?

$P(X=4) = 0.0488$

c. What is the probability that at least 3 households with dogs?

$P(X \geq 3) = 0.2688$

d. What is the probability that less than 2 households have dogs?

$P(X < 2) = 0.3589$

e. What is the probability that none of the households have a dog?

$P(X=0) = 0.0789$

f. What is the probability that at least 1 household has a dog?

$P(X \geq 1) = 0.9211$

MULTIPLE CHOICE

1. In government data, a household consists of all occupants of a dwelling unit. Choose an American household at random and count the number of people it contains. Here is the assignment of probabilities for your outcome:

Number of persons	1	2	3	4	5	6	7
Probability	0.25	0.32	???	???	0.07	0.03	0.01

The probability of finding 3 people in a household is the same as the probability of finding 4 people. These probabilities are marked ??? in the table of the distribution. The probability that a household contains 3 people must be

(a) 0.68 (b) 0.32 (c) 0.16 (d) 0.08 (e) between 0 and 1, and we can say no more.

2. Which of the following statements about a table of random digits is **true**?
(a) If each line contains 40 digits, there will be exactly 4 zeros in every line.
(b) The probability that there are exactly 4 zeros in a line of 40 digits is exactly 0.5.
(c) The number of zeros in a line of 40 digits will vary, but on the average there will be 4 zeros per line.
(d) There can never be 4 zeros in a row because that pattern isn't random.
(e) Both (c) and (d) are true.

3. A friend rolls cheap dice many times. He reports that the probabilities of the possible outcomes are about as follows:

Outcome	1	2	3	4	5	6
Probability	0.2	0.2	0.2	0.1	0.1	0.2

Is this a legitimate probability model?
(a) Yes.
(b) No -- the faces must all have the same probability.
(c) No -- the 3 and 4 faces are opposite each other, so they must have the same probability.
(d) No -- the total probability for all faces is wrong.
(e) No -- not all the values given are possible values for a probability.

Choose an American household at random and ask how many cars and trucks that household owns. Here are the probabilities as of 1997:

Number of vehicles	0	1	2	3	4	5
Probability	0.04	0.25	0.45	0.18	0.06	0.02

4. This is a legitimate assignment of probabilities because it satisfies these rules:
(a) all the probabilities are between 0 and 1.
(b) all the probabilities are between -1 and 1.
(c) the sum of all the probabilities is exactly 1.
(d) Both (a) and (c).
(e) Both (b) and (c).

5. What is the probability that a randomly chosen household owns more than one motor vehicle?
(a) 0.96 (b) 0.71 (c) 0.26 (d) 0.25

9. If I toss a fair coin five times and the outcomes are TTTTT, then the probability that tails appears on the next toss is
(a) 0.5 (b) less than 0.5 (c) greater than 0.5 (d) 0 (e) 1

10. If a coin has 0.6 probability coming up tails, the probability that it comes up heads is
(a) 0.5 (b) -0.2 (c) 0.4 (d) 0.6 (e) 1.0

12. The probability that the sum is 7 when you roll two dice is 1/6; the probability that the sum is 11 is 1/18. Suppose you play a game where you win if the sum is 7 or 11. What is the probability that you win?
(a) 2/6 (b) 2/18 (c) 7/6 (d) 2/9 (e) 2/24

13. If I toss a fair coin 5000 times
(a) the number of heads will be close to 2500
(b) the proportion of heads will be close to 0.5
(c) the price of oranges will increase
(d) the proportion of heads in these tosses is a parameter
(e) the proportion of heads will be close to 50

BOTH (A) and (B)

20. A household is a group of people living together at the same address. Choose one American household at random and record how many people it contains. Here are the probabilities:

Number of people	1	2	3	4	5	6	7 or more
Probability	?	0.32	0.17	0.16	0.07	0.02	0.01

What is the probability that the household chosen contains only one person?
(a) 0.15 (b) 0.25 (c) 0.35 (d) 0.75 (e) Can't tell from the information given.

21. What is the probability that a randomly chosen household contains 4 or more people?
(a) 0.10 (b) 0.16 (c) 0.26 (d) 0.90 (e) Can't tell from the information given.

22. A poker player is dealt poor hands for several hours. He decides to bet heavily on the last hand of the evening on the grounds that after many bad hands he is due for a winner.
(a) He's right, because the winnings have to average out.
(b) He's wrong, because successive deals are independent of each other.
(c) He's right, because successive deals are independent of each other.
(d) He's wrong, because his expected winnings are $0 and he's below that now.

6. In government data, a family consists of two or more persons who live together and are related by blood or marriage. Choose an American family at random and count the number of people it contains. Here is the assignment of probabilities for your outcome:

Number of persons	2	3	4	5	6	7
Probability	0.42	0.23	0.21	0.09	0.03	0.02

What is the probability that the family you choose has more than 2 people?
(a) 0.35 (b) 0.42 (c) 0.58 (d) 1.00 (e) Between 0 and 1, and we can say no more.

7. Using the probabilities in the previous question, what is the expected size of the family you draw?
(a) 2 people (b) 3 people (c) 3.14 people (d) 3.5 people (e) 4.5 people

10. A gambler who keeps placing $1 bets on roulette will, after a very large number of bets, find that his average winnings per bet are close to $0.947. (The house keeps the other $0.053 per bet.) The statistical term for the number $0.947 is
(a) the probability of winning a bet (b) the bias of a bet (c) a random # (d) the expected value of a bet.

12. You play a game with two possible outcomes. Outcome A has probability 0.4 and outcome B has probability 0.6. When B occurs you win $2.00; otherwise, you lose $1.00. What is your expected value for this game?
(a) $2.00 (b) -$0.10 (c) $0.20 (d) -$0.80 (e) $0.80